THIN INTERFACE PELLICLE FOR DENSE ARRAYS OF ELECTRICAL INTERCONNECTS

FIELD OF THE INVENTION

This invention relates to semiconductor and package testing as well as electrical interconnections and in particular, to a thin interface pellicle, film or membrane which contains contacts and vias on both sides for interconnecting a semiconductor chip or wafer to a space transformer for electrical testing or to a package structure for utilization.

BACKGROUND OF THE INVENTION

Semiconductor devices or chips and other electrical devices normally are electrically interconnected for testing, burn-in and utilization. Interconnection methods have included rigid probes and contacts, flexible probes and contacts, wire bonding, soldering and welding. The topology of the interconnections on a chip has varied from a line or linear array of peripherally spaced pads, bumps or contacts to an area array of two dimensionally spaced pads or bumps. The pads or bumps in either a linear or area array normally have a uniform width and center to center spacing in the array. The array of contacts in an area array are usually arranged in a pattern such as rows and columns orthogonal to one another. The trend in integrated circuit chips or dies is for denser arrays of contacts and for more contacts per chip. One manufacturer, International Business Machines Corporation, Armonk, N.Y., uses a contact called a C4 bump which extends above the integrated circuit by about 0.125 millimeters and which is composed mostly of lead and tin (Pb-Sn) and is round or circular in cross-section parallel to the plane of the array and is curved from its sides to the top surface of the bump where the interconnection is made to another electrode. In U.S. Pat. No. 3,401,126 granted September, 1986 to L. F. Miller, a highly conductive electrode which is substantially not wetted by solder is described. In U.S. Pat. No. 3,429,040 granted February, 1969 to L. F. Miller, ductile contacts of a microminiature element which may be joined to connecting areas at the surface of an insulating substrate is described. Both of the above patents are assigned to the assignee herein.

In order to test high density two-dimensional arrays of contacts at high speeds, the current probing apparatus has been modified to be correspondingly more dense. One type or category of probe is known as a "Cobra Probe" which is described in U.S. Pat. No. 4,038,599 granted Jul. 26, 1977 to Bove et al. The Cobra Probe has a plurality of wires mounted in parallel with their ends ending in a plane transverse to the axis of the wires. The wire ends are also shaped to facilitate probing. Each wire is also rigid enough to apply pressure to the corresponding contact when mechanically moved against the contact yet flexible or springy enough to prevent excessive pressure on or deformation of the contact. While each wire is aligned correctly its ends are floating and the cumulative pressure exerted by the wires is large with respect to the area of the contacts. The wires sometimes short out to adjacent wires or carry dirt and fragments which are dropped on the array. Further an array of Cobra Probes is limited by its mechanical assembly, electrical bandwidth due to capacitance and inductance, and center-to-center spacing of probes or array density. The Cobra Probe may have probe wires 5.08 mm (0.20 in.) long, a diameter of 0.102 mm (0.004 in.), a center-to-center spacing of 0.203 mm (0.008 in.), a self-inductance of 2.5 nH and a bulk resistance of 180 millohms.

Presently interconnections during burn-in of semiconductor devices must withstand extreme temperature changes as well as long times at extreme temperatures. Chip signal terminals and power terminals are sometimes soldered for this purpose and then resoldered for utilization. Faulty interconnections during burn-in or testing can be attributed to a failure of the chip. The chips which are tested faulty are sometimes discarded with out further testing.

In U.S. Pat. No. 3,541,222 which issued on Nov. 17, 1970 to H. L. Parks et al., a connector screen is described for interconnecting adjacent surfaces of laminar circuits. A sheet of insulating material is provided containing a matrix of spaced apart conductive connector elements embedded in the sheet and protruding from both sides.

In U.S. Pat. No. 3,654,585 which issued on Apr. 4, 1972 to P. D. Wickersham, a transition plate is described which comprises a thin baseplate of insulating material, such as a thin fiberglass sheet with a layer of copper on each side being etched to leave only the contact pads on the bottom side of the baseplate and the contact pads on the top side of the baseplate electrically interconnected through the baseplate to provide a coordinate conversion interface between an array of spring pins connected to a tester and a printed circuit board to be tested.

In U.S. Pat. No. 4,581,679 which issued on Apr. 8, 1986 to R. Smolley, an interconnection medium is described that includes an insulated board with openings through it, and a number of connector elements in the form of compressible wads of conductive wire inserted therein. The connector elements inserted in selected openings in the insulated board are compressed into contact with contact areas formed on the circuit package elements.

In U.S. Pat. No. 4,707,657 which issued on Nov. 17, 1987 to A. Boegh-Petersen, a connector assembly is described comprising a printed circuit board having pads arranged on both surfaces with interconnections therethrough for connecting a printed circuit board tester to a printed circuit board to be tested. Spherical, cylindrical, cubic or wire mesh bodies may be placed above the pads to provide a contact interface to the connector interface. Also a sheet made of electrically insulating material with through-going electrically conductive paths embedded therein may be placed over the pads. Coil springs in recessed holes over pads may position metal contacts above the springs against an adjacent surface or test pad.

In U.S. Pat. No. 4,837,507 which issued on Jun. 6, 1989 to C. D. Hechtman, a high frequency test fixture is described incorporating a support body including an electrically conducting compliant medium having parallel major surfaces and a first and second array of bendable Euler column probes held by the support body and extending between the major surfaces of the support body. Each probe of the first array of probes may be electrically insulated from the compliant medium. The second array of probes being positioned between two adjacent probes of the first array and may be in electrical contact with the compliant medium.

A connector manufactured by Rogers Corporation, One Technology Drive, Rogers, Conn. has a pressure-